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Animal toxicity problems perceived to be associated with different pasture types on East Coast sheep/beef farms

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ABSTRACT

A survey on the East Coast of the North Island was conducted to provide information on the on-farm performance of drought tolerant pastures, including perceptions on animal toxicity problems. During October-December 1990 over 250 paddocks on 102 sheep/beef farms in Gisborne (23), Hawkes Bay (32) and the Wairarapa (47) were surveyed. Botanical composition was measured for each survey paddock from turf cores. No animal health problems were reported for prairie grass pastures, but farmers commented on improved animal performance from this pasture type. Animal health problems mentioned by farmers surveyed were: (1) ryegrass staggers, being reported for 58% of survey farms and 9% of survey paddocks. Ryegrass staggers was usually mentioned for paddocks with a high perennial ryegrass content (>40% cores containing ryegrass). It was mentioned less frequently for mixed ryegrass-cocksfoot swards (>40% ryegrass, >10% cocksfoot) than for swards containing similar levels of ryegrass but little cocksfoot. (2) Bloat was mentioned more frequently for paddocks sown with tall fescue (15%) than for other pasture types (3%). Tall fescue swards had a higher clover content than ryegrass swards. (3) Stock ill-thrift (low growth rate) was mentioned for 6 of the 260 survey paddocks. The common feature of these paddocks was a moderate to high cocksfoot content (21-72% cores containing cocksfoot). (4) Phalaris toxicity was mentioned by 18% of farmers who had phalaris pastures.

Keywords: Ryegrass staggers, Bloat, Phalaris toxicity, East Coast, perennial ryegrass, tall fescue, phalaris, prairie grass.

INTRODUCTION

Recent droughts on the East Coast of the North Island have increased awareness of the potential value of alternative and new pasture cultivars. East Coast farmers have similar patterns of cultivar use to farmers in other regions of New Zealand (Belgrave et al. 1990), with perennial ryegrass being the most frequently used species, and with a limited number of farmers using more drought tolerant grasses. A farm survey was conducted, as part of the Ministry and Agriculture and Fisheries East Coast Drought Recovery Programme, to collect data on the on-farm performance of drought tolerant pastures. Animal health problems perceived to be associated with different pasture types are reported in this paper, and other aspects will be reported elsewhere. A second survey, of farm consultants and scientists, was conducted to allow comparison with farmer perception of drought tolerant pastures.

The pasture types surveyed were tall fescue (Festuca arundinacea), prairie grass (Bromus willdenowi), cocksfoot (Dactylis glomerata), phalaris (Phalaris aquatica), and perennial ryegrass (Lolium perenne). Of these pasture types, prairie grass and cocksfoot have not been associated with specific animal health problems (Connor 1977). Perennial ryegrass, phalaris and tall fescue pastures have all been reported to be associated with animal disorders (Connor 1977).

Perennial ryegrass dominant pastures are associated with the neuromuscular disorder ‘ryegrass staggers’ (Connor 1977). Ryegrass containing the endophyte fungus Acremonium lolii can cause staggers in summer and autumn, especially when close grazed (Mortimer et al. 1984, Fletcher et al. 1990).

Phalaris dominant pastures on the East Coast have been reported to cause deaths and staggers in livestock (Connor 1977, Wright et al. 1981). Phalaris is recommended for dryland pastures because of its valuable agronomic attributes, but it is advised that phalaris be sown in mixture with cocksfoot and/or tall fescue to reduce the risk of phalaris toxicity (Milne & Moloney 1990).

Tall fescue has been associated with animal health problems in New Zealand, but plant improvement has been used to solve the problem. Fescue foot is the main disorder associated with naturalised tall fescue growing in wet wasteland areas of New Zealand, mainly affecting cattle but also sheep (Connor 1977). Naturalised tall fescue in pastures have also been suspected of causing fescue-associated bovine hyperthermia (Keams 1986). Modern cultivars of tall fescue used for pasture (Grasslands Roa, AU Triumph) are not infected with a toxin-producing endophyte fungus Acremonium coenophialum and are considered free of toxic effects (Hoveland et al. 1983, Brock 1983, Keams 1986).

MATERIALS AND METHODS

Farm survey

A survey of sheep/beef farms located on the East Coast of the North Island was conducted during October-December 1990. The survey involved locating paddocks planted over the previous 10 years, sending farmers questionnaires, and visiting survey paddocks to measure botanical composition. Paddocks surveyed were not randomly selected, but were selected in a stratified manner to obtain a balance of pasture types (perennial ryegrass, tall fescue, cocksfoot, prairie grass), pasture ages (1-5 or 6-10 years old) and districts (Gisborne, Hawkes Bay, Wairarapa). Suitable paddocks were identified...
from contacts with seed merchants, farm consultants and farmers.

Farmers were contacted by telephone to check that they were willing to participate in the survey. Participating farmers were then posted survey forms to complete (Farm Details form, one per farm, and Paddock Details form, one per paddock surveyed). Survey forms had questions on agronomic aspects of pasture establishment and performance. Each farm was visited in October-December 1990 to check that farmers had completed survey forms, to collect forms, and to visit survey paddocks. Survey paddocks were sampled to measure botanical composition and details of paddock topography, altitude, etc were recorded. Botanical composition of each paddock was measured by taking 100 five cm diameter turf cores per paddock (Mitchell & Glenday 1958), and recording the percentage of cores with different species present.

Farmers were asked about animal health problems twice, in the Farm Details Form and in the Paddock Details Form. In the Farm Details Form they were asked to rank perennial ryegrass, tall fescue, prairie grass, cocksfoot and phalaris on a scale of 1-6 for animal health problems (1 = "None", 6 = "Lots"), based on their own observations, knowledge and experience. They were also asked "What animal health problems have you experienced with these grasses?" In the Paddock Details Form farmers were asked "What animal health problems have you had with the survey paddock?" Farmers generally completed questionnaires before being visited by interviewers.

Each survey paddock was classified as having ryegrass staggers and bloat either mentioned by the farmer (Mentioned) or not mentioned (None). The STEPDISC procedure (stepwise discriminant analysis) within the statistical package SAS (SAS 1987) was used to discriminate between paddocks classified as "Mentioned" and "None". For the first analysis, tiller core results were used as the independent variables to identify which pasture species were associated with the problem. In a second analysis, 16 management variables were available for selection (Korte et al. 1991). Each animal health problem was analyzed separately. \( \chi^2 \) tests were used to test significance of factors.

Science and farm consultant survey

During 1990 and 1991 scientists and science technicians known to have been involved in pasture species research were surveyed. Farm consultants working on the East Coast of the North Island were surveyed. Both groups were asked, based on their observations, knowledge and experience, to rank pasture species for animal health problems (using the same animal health question used in the Farm Details Form of the farm survey). The percentage of scientists and technicians (n=66) who had conducted experiments with different grasses were: perennial ryegrass 95%, cocksfoot 82%, tall fescue 82%, prairie grass 82%, and phalaris 71%. The percentage of farm consultants (n=24) with clients who had sown different grasses in the 4 years before the survey were: perennial ryegrass 86%, cocksfoot 82%, tall fescue 82%, prairie grass 59% and phalaris 45%. Farm consultants were mainly employed by the Ministry of Agriculture & Fisheries (n=17) or were specialist pasture or seed consultants (n=7).

RESULTS AND DISCUSSION

The farm survey involved 102 farms and 260 paddocks, with 1-6 paddocks per farm. The survey was biased towards farms involved in pasture renewal because of the sample selection method used (Korte et al. 1991). Compared with "average" sheep/beef farms on the East Coast the survey farms were more highly stocked (11 SU ha\(^{-1}\)) and had more crop (24 ha). Survey paddocks were mainly located on cultivable land (76% less than 10° slope), at low altitude (66% 0-150 m, 18% 150-300 m), with relatively low annual rainfall (42% 700-1000 mm, 44% 1000-1500 mm). Survey paddocks were usually established in autumn (86%) after a cereal or greenfeed crop (78%) using conventional cultivation and sowing techniques (75%).

Pastures sown with mixtures of ryegrass and cocksfoot were readily located for the survey, but specialist tall fescue, prairie grass or cocksfoot pastures were less abundant, especially specialist paddocks over 5 years old. Of the farmers surveyed, the percentage that had sown different pasture species in the previous 5 years was as follows: ryegrass 66%, cocksfoot 65%, tall fescue 59%, prairie grass 43%, and phalaris 22%.

This survey concentrated on agronomic aspects of pastures, with questions on animal health being a minor component of the study. As a consequence, animal health professionals were not included in the farm consultant survey. No explicit definition of "animal health problems" was given in the questionnaires. Presumably because of the context, animal health problems of a general nature (flystrike, parasitism, etc) were not mentioned by farmers.

Ranking of species

Farmers ranked ryegrass as having most animal health problems, with cocksfoot, tall fescue and prairie grass being ranked as having few problems (Table 1). Phalaris was ranked between ryegrass and the other species. There was considerable variation in the number of farmers responding to the question, with response rate being highest for ryegrass (89%) and lowest for phalaris (19%). Variation in response rate appeared to reflect farmer experience with a pasture species, there being a tendency for farmers to only express an opinion on a pasture after they had some personal experience. For example with tall fescue, 69% of farmers who had sown tall fescue in the previous 5 years responded to the question, while only 7% of farmers who had not sown tall fescue responded. Similarly, the low farmer response rate for phalaris was related to relative inexperience with this species. Of the 24 farmers who had sown phalaris in the past five years, half responded to the question; only 9% of farmers who had not sown phalaris recently expressed an opinion on phalaris health problems.

Farmer rankings of health problems were generally consistent with those of scientists and consultants for all species except phalaris (Table 1). Although 53% of responding farmers considered phalaris as causing few health prob-
TABLE 1: Mean ranking of different pasture types for animal health problems by farmers, scientists and consultants (Rank: 1 = no problems, 6 = lots of problems). The frequency of rankings for each question is also shown.

<table>
<thead>
<tr>
<th>Botanical components</th>
<th>Mean percentage of cores containing species class.</th>
<th>Percentage of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean rank</td>
<td>Unimportant (1&amp;2) Moderate (3&amp;4) Serious (5&amp;6) No response</td>
<td></td>
</tr>
<tr>
<td>Farmer responses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=102)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryegrass</td>
<td>4.2</td>
<td>15</td>
</tr>
<tr>
<td>Phalaris</td>
<td>3.0</td>
<td>10</td>
</tr>
<tr>
<td>Cocksfoot</td>
<td>1.9</td>
<td>44</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>1.5</td>
<td>37</td>
</tr>
<tr>
<td>Prairie grass</td>
<td>1.3</td>
<td>33</td>
</tr>
<tr>
<td>Consultant responses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=24)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryegrass</td>
<td>4.5</td>
<td>4</td>
</tr>
<tr>
<td>Phalaris</td>
<td>4.5</td>
<td>0</td>
</tr>
<tr>
<td>Cocksfoot</td>
<td>2.0</td>
<td>63</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>2.3</td>
<td>58</td>
</tr>
<tr>
<td>Prairie grass</td>
<td>1.6</td>
<td>79</td>
</tr>
<tr>
<td>Scientist responses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=66)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryegrass</td>
<td>4.0</td>
<td>11</td>
</tr>
<tr>
<td>Phalaris</td>
<td>4.1</td>
<td>5</td>
</tr>
<tr>
<td>Cocksfoot</td>
<td>1.8</td>
<td>51</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>2.0</td>
<td>50</td>
</tr>
<tr>
<td>Prairie grass</td>
<td>1.6</td>
<td>62</td>
</tr>
</tbody>
</table>

Rye grass staggers

Rye grass staggers was the predominant animal health problem listed by farmers in the Farm Details questionnaire, being listed by 58% of farmers. In the Paddock Details questionnaire, it was mentioned for 9% of survey paddocks.

Simple correlations were calculated between environmental variables and farmer animal health rankings. Moderate to serious health problems for ryegrass and phalaris were reported more frequently in lower rainfall areas. The correlations between annual rainfall and ryegrass or phalaris health ratings were 0.32 (P < 0.01) and -0.64 (P < 0.01) respectively. Ryegrass health problems were also more serious at lower altitude (r = 0.35, P < 0.01). No association with environmental variables was detected for tall fescue, cocksfoot or prairie grass.

TABLE 2: Botanical components and management variables associated with ryegrass staggers. Variables selected by stepwise discriminant analysis and variable means are given in the table.

Paddock classification for ryegrass staggers

<table>
<thead>
<tr>
<th>Botanical components</th>
<th>Mentioned (n=24)</th>
<th>None (n=229)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perennial ryegrass</td>
<td>66%</td>
<td>33%</td>
</tr>
<tr>
<td>&quot;Other clovers&quot;</td>
<td>17%</td>
<td>5%</td>
</tr>
<tr>
<td>&quot;Other grasses&quot;</td>
<td>26%</td>
<td>37%</td>
</tr>
<tr>
<td>Subterranean clover</td>
<td>17%</td>
<td>8%</td>
</tr>
<tr>
<td>Management variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryegrass seed rate (kg/ha)</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>Annual rainfall (mm)</td>
<td>961</td>
<td>1098</td>
</tr>
<tr>
<td>Cocksfoot seed rate (kg/ha)</td>
<td>1.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Cattle stock units (%)</td>
<td>24</td>
<td>36</td>
</tr>
</tbody>
</table>

1 Mean percentage of cores containing species class.
2 As a percentage of total stock units.
white clover (Korte et al. 1991). Reduced annual rainfall was also associated with increased prevalence of staggers (Figure 1). Ryegrass staggers was not reported for any paddock with a mean annual rainfall greater than 1500 mm. For paddocks with a high ryegrass content (>40% cores with ryegrass), the frequency of staggers was respectively 17% and 37% where rainfall was 1000-1500 mm and 700-1000 mm. White clover could have reduced the risk of staggers in a similar manner to that discussed for other grasses at high rainfall sites. At low rainfall sites where annual legumes predominate, little or no legume growth occurs during late summer and early autumn. During droughts the limited growth of ryegrass pastures results in closer grazing, which in turn, increases the ingestion of toxins causing ryegrass staggers (Fletcher et al. 1990).

FIGURE 1: Association between annual rainfall and ryegrass staggers prevalence or clover content of swards. Fitted regressions for clover content are from Korte et al (1991) and the regression for staggers is a maximum likelihood logistic regression fitted to paddocks with more than 40% cores with ryegrass (χ² for rain = 6.6, P<0.01).

Bloat

Bloat was mentioned by 2% of farmers in the Farm Detail questionnaire and was listed as a problem for 6% of the survey paddocks in the Paddock Details questionnaire. Stepwise discriminant analysis of the paddock data indicated that bloat was most strongly associated with clover dominant tall fescue pasture on farms with a high percentage of cattle stock units (Table 3). Bloat was mentioned for 15% of paddocks sown with tall fescue compared to 3% of paddocks with no tall fescue (χ²=9.6, d.f.=1, P<0.01). No effect of other grasses on bloat was evident. Although cocksfoot tends to be more competitive towards clovers than other grasses (Watkin, 1975, Korte et al., 1991), paddocks sown with tall fescue/ cocksfoot mixtures had a similar incidence of bloat to paddocks sown with tall fescue as the sole grass.

Bloat was mentioned more frequently in paddocks sown with both red and white clover (10%) than in paddocks sown with white clover but not red clover (2%). The effects of tall fescue and red clover in combination on the odds ratio were approximately multiplicative. Bloat was mentioned for 26% of paddocks sown with both tall fescue and red clover, for 6% of paddocks sown with tall fescue and no red clover, for 6% of paddocks sown with other grasses plus red clover and for only 1% of paddocks sown without either tall fescue or red clover. Under a logit-linear model, the single degree-of-freedom χ²'s for the effects of tall fescue and red clover were 10.0 (P<0.01) and 7.2 (P<0.01), respectively. Their interaction was not significant (χ²=0.01).

Other problems

Ill-thrift (lower growth rates than expected in the apparent absence of other disease) was mentioned by farmers for 2% of the survey paddocks (n=6). A common feature of these paddocks was a moderate to high cocksfoot content (21%-72% of cores contained cocksfoot). Ill-thrift was possibly due to low clover content in cocksfoot dominant pastures (Korte et al. 1991).

Facial eczema was mentioned by 10% of farmers in the farm detail form, with the prevalence being higher for Gisborne and Hawkes Bay (16%) than for the Wairarapa (2%). Some farmers commented that facial eczema was not associated with any particular pasture type.

Four farmers mentioned phalaris poisoning, an occurrence of 18% (22 farmers indicated they had planted phalaris in 1987-90). This was a relatively high percentage, but conclusions regarding phalaris are limited by lack of data. At the time of survey relatively few farmers on the East Coast of the North Island had planted phalaris.

No farmers with tall fescue pasture reported fescue foot (Connor 1977) or fescue-associated hyperthermia (Kearns 1986).

No animal health problems were associated with prairie grass pastures. A number of farmers commented favourably on improved animal performance associated with this pasture type.

CONCLUSIONS

In general East Coast farmers, consultants and scientist have similar perceptions of animal health problems associated with different pasture types. The main difference in perception identified was for phalaris. From a technology transfer point of view, it is interesting to note that farmers were only willing to express an opinion on different grasses after they had experience with them.

The main animal health problem associated with a specific pasture type was ryegrass staggers, which farmers
recognised could be overcome by planting specialist pastures of other grasses. Further research is required to define levels of contamination by volunteer perennial ryegrass that can occur before risk of staggers is increased. The finding that cocksfoot can reduce prevalence of staggers has important implications for ryegrass dominant hill country pastures, farmers could introduce the species relatively cheaply by aerial oversowing (Macfarlane, 1987) to reduce staggers.

As expected, tall fescue, cocksfoot and prairie grass were relatively free of specific animal health problems. High clover content and bloat in tall fescue pastures was probably caused by slow establishment of tall fescue compared with ryegrass (Brock 1983). Although high clover content can be a disadvantage for cattle, farmers are generally able to manage the problem, and it is compensated for by increased rates of sheep and cattle liveweight gain (Thomson 1979).

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REFERENCES


